Quick Quiz for AP* Preparation: Sections 1.4–1.6

1. Multiple Choice Which of the following is the domain of $f(x) = -\log_2(x + 3)$?

(A) $(-\infty, \infty)$ (B) $(-\infty, 3)$ (C) $(-3, \infty)$
(D) $[-3, \infty)$ (E) $(-\infty, 3]$

2. Multiple Choice Which of the following is the range of $f(x) = 5\cos(x + \pi) + 3$?

(A) $(-\infty, \infty)$ (B) $[2, 4]$ (C) $[-8, 2]$
(D) $[-2, 8]$ (E) $\left[-\frac{2}{5}, \frac{8}{5}\right]$

3. Multiple Choice Which of the following gives the solution of $\tan x = -1$ in $\pi < x < \frac{3\pi}{2}$?

(A) $-\frac{\pi}{4}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{3\pi}{4}$ (E) $\frac{5\pi}{4}$

4. Free Response Let $f(x) = 5x - 3$.

(a) Find the inverse g of f.
(b) Compute $f \circ g(x)$. Show your work.
(c) Compute $g \circ f(x)$. Show your work.

Chapter 1 Key Terms

absolute value function (p. 17)
base a logarithm function (p. 39)
boundary of an interval (p. 13)
boundary points (p. 13)
change of base formula (p. 41)
closed interval (p. 13)
common logarithm function (p. 40)
composing (p. 18)
composite function (p. 17)
compounded continuously (p. 25)
cosecant function (p. 45)
cosine function (p. 45)
cotangent function (p. 45)
dependent variable (p. 12)
domain (p. 12)
even function (p. 15)
exponential decay (p. 24)
exponential function base a (p. 22)
exponential growth (p. 24)
function (p. 12)
general linear equation (p. 5)
graph of a function (p. 13)
graph of a relation (p. 29)
grapher failure (p. 15)
half-life (p. 24)
half-open interval (p. 13)
identity function (p. 37)
increments (p. 3)
independent variable (p. 12)
initial point of parametrized curve (p. 29)
interior of an interval (p. 13)
interior points of an interval (p. 13)
inverse cosecant function (p. 49)
inverse cosine function (p. 49)
inverse cotangent function (p. 49)
inverse function (p. 37)
inverse properties for a^x and $\log_a x$ (p. 40)
inverse secant function (p. 49)
inverse sine function (p. 49)
inverse tangent function (p. 49)
linear regression (p. 7)
natural domain (p. 13)
natural logarithm function (p. 40)
odd function (p. 15)
one-to-one function (p. 36)
open interval (p. 13)
parallel lines (p. 4)
parameter (p. 29)
parameter interval (p. 29)
parametric curve (p. 29)
parametric equations (p. 29)
parametrization of a curve (p. 29)
parametrize (p. 29)
period of a function (p. 46)
periodic function (p. 46)
perpendicular lines (p. 4)
piecewise-defined function (p. 16)
point-slope equation (p. 4)
power rule for logarithms (p. 40)
product rule for logarithms (p. 40)
quotient rule for logarithms (p. 40)
radian measure (p. 45)
range (p. 12)
regression analysis (p. 7)
regression curve (p. 7)
relation (p. 29)
rise (p. 3)
rules for exponents (p. 23)
run (p. 3)
scatter plot (p. 7)
secant function (p. 45)
sine function (p. 45)
sinusoid (p. 47)
sinusoidal regression (p. 48)
slope (p. 4)
slope-intercept equation (p. 5)
symmetry about the origin (p. 15)
symmetry about the y-axis (p. 15)
tangent function (p. 45)
terminal point of parametrized curve (p. 29)
witch of Agnesi (p. 32)
x-intercept (p. 5)
y-intercept (p. 5)

Chapter 1 Review Exercises

Exercise numbers with a gray background indicate problems that the authors have designed to be solved without a calculator.

The collection of exercises marked in red could be used as a chapter test.

In Exercises 1–14, write an equation for the specified line.

1. through $(1, -6)$ with slope 3
2. through $(-1, 2)$ with slope $-1/2$
3. the vertical line through $(0, -3)$
4. through $(-3, 6)$ and $(1, -2)$
5. the horizontal line through $(0, 2)$
6. through $(3, 3)$ and $(-2, 5)$
7. with slope -3 and y-intercept 3
8. through $(3, 1)$ and parallel to $2x - y = -2$
9. through $(4, -12)$ and parallel to $4x + 3y = 12$
10. through $(-2, -3)$ and perpendicular to $3x - 5y = 1$
11. through $(-1, 2)$ and perpendicular to $\frac{1}{2}x + \frac{1}{3}y = 1$
12. with x-intercept 3 and y-intercept -5
13. the line $y = f(x)$, where f has the following values:

x	-2	2	4
$f(x)$	4	2	1

14. through $(4, -2)$ with x-intercept -3

In Exercises 15–18, determine whether the graph of the function is symmetric about the y-axis, the origin, or neither.

15. $y = x^{1/5}$
16. $y = x^{2/5}$
17. $y = x^2 - 2x - 1$
18. $y = e^{-x^2}$

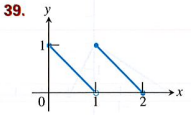
In Exercises 19–26, determine whether the function is even, odd, or neither.

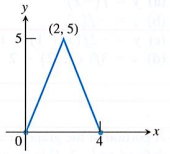
19. $y = x^2 + 1$
20. $y = x^5 - x^3 - x$
21. $y = 1 - \cos x$
22. $y = \sec x \tan x$
23. $y = \dfrac{x^4 + 1}{x^3 - 2x}$
24. $y = 1 - \sin x$
25. $y = x + \cos x$
26. $y = \sqrt{x^4 - 1}$

In Exercises 27–38, find the **(a)** domain and **(b)** range, and **(c)** graph the function.

27. $y = |x| - 2$
28. $y = -2 + \sqrt{1 - x}$
29. $y = \sqrt{16 - x^2}$
30. $y = 3^{2-x} + 1$
31. $y = 2e^{-x} - 3$
32. $y = \tan(2x - \pi)$
33. $y = 2\sin(3x + \pi) - 1$
34. $y = x^{2/5}$
35. $y = \ln(x - 3) + 1$
36. $y = -1 + \sqrt[3]{2 - x}$
37. $y = \begin{cases} \sqrt{-x}, & -4 \le x \le 0 \\ \sqrt{x}, & 0 < x \le 4 \end{cases}$
38. $y = \begin{cases} -x - 2, & -2 \le x \le -1 \\ x, & -1 < x \le 1 \\ -x + 2, & 1 < x \le 2 \end{cases}$

In Exercises 39 and 40, write a piecewise formula for the function.

39.


40.


In Exercises 41 and 42, find

(a) $(f \circ g)(-1)$ **(b)** $(g \circ f)(2)$ **(c)** $(f \circ f)(x)$ **(d)** $(g \circ g)(x)$

41. $f(x) = \dfrac{1}{x}, \quad g(x) = \dfrac{1}{\sqrt{x + 2}}$
42. $f(x) = 2 - x, \quad g(x) = \sqrt[3]{x + 1}$

In Exercises 43 and 44, **(a)** write a formula for $f \circ g$ and $g \circ f$ and find the **(b)** domain and **(c)** range of each.

43. $f(x) = 2 - x^2, \quad g(x) = \sqrt{x + 2}$
44. $f(x) = \sqrt{x}, \quad g(x) = \sqrt{1 - x}$

In Exercises 45–48, a parametrization is given for a curve.

(a) Graph the curve. Identify the initial and terminal points, if any. Indicate the direction in which the curve is traced.

(b) Find a Cartesian equation for a curve that contains the parametrized curve. What portion of the graph of the Cartesian equation is traced by the parametrized curve?

45. $x = 5\cos t, \quad y = 2\sin t, \quad 0 \le t \le 2\pi$
46. $x = 4\cos t, \quad y = 4\sin t, \quad \pi/2 \le t < 3\pi/2$
47. $x = 2 - t, \quad y = 11 - 2t, \quad -2 \le t \le 4$
48. $x = 1 + t, \quad y = \sqrt{4 - 2t}, \quad t \le 2$

In Exercises 49–52, give a parametrization for the curve.

49. the line segment with endpoints $(-2, 5)$ and $(4, 3)$
50. the line through $(-3, -2)$ and $(4, -1)$
51. the ray with initial point $(2, 5)$ that passes through $(-1, 0)$
52. $y = x(x - 4), \quad x \le 2$

Group Activity In Exercises 53 and 54, do the following.

(a) Find f^{-1} and show that $(f \circ f^{-1})(x) = (f^{-1} \circ f)(x) = x$.

(b) Graph f and f^{-1} in the same viewing window.

53. $f(x) = 2 - 3x$
54. $f(x) = (x + 2)^2, \quad x \ge -2$

In Exercises 55 and 56, find the measure of the angle in radians and degrees.

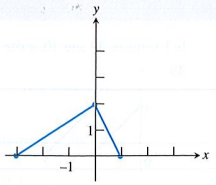
55. $\sin^{-1}(0.6)$
56. $\tan^{-1}(-2.3)$

57. Find the six trigonometric values of $\theta = \cos^{-1}(3/7)$. Give exact answers.
58. Solve the equation $\sin x = -0.2$ in the following intervals.

(a) $0 \le x < 2\pi$ **(b)** $-\infty < x < \infty$

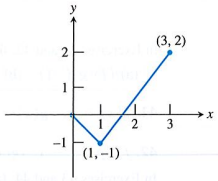
59. Solve for x: $e^{-0.2x} = 4$

60. The graph of f is shown. Draw the graph of each function.



(a) $y = f(-x)$
(b) $y = -f(x)$
(c) $y = -2f(x + 1) + 1$
(d) $y = 3f(x - 2) - 2$

61. A portion of the graph of a function defined on $[-3, 3]$ is shown. Complete the graph assuming that the function is



(a) even.
(b) odd.

62. ***Depreciation*** Smith Hauling purchased an 18-wheel truck for $100,000. The truck depreciates at the constant rate of $10,000 per year for 10 years.

(a) Write an expression that gives the value y after x years.
(b) When is the value of the truck $55,000?

63. ***Drug Absorption*** A drug is administered intravenously for pain. The function

$$f(t) = 90 - 52 \ln (1 + t), \quad 0 \le t \le 4$$

gives the number of units of the drug in the body after t hours.

(a) What was the initial number of units of the drug administered?
(b) How much is present after 2 hours?
(c) Draw the graph of f.

64. ***Finding Time*** If Joenita invests $1500 in a retirement account that earns 8% compounded annually, how long will it take this single payment to grow to $5000?

65. ***Guppy Population*** The number of guppies in Susan's aquarium doubles every day. There are four guppies initially.

(a) Write the number of guppies as a function of time t.
(b) How many guppies were present after 4 days? after 1 week?
(c) When will there be 2000 guppies?
(d) **Writing to Learn** Give reasons why this might not be a good model for the growth of Susan's guppy population.

66. ***Doctoral Degrees*** Table 1.23 shows the number of doctoral degrees earned by Hispanic students for several years. Let $x = 0$ represent 1990, $x = 1$ represent 1991, and so forth.

TABLE 1.23
Doctorates Earned by Hispanic Americans

Year	Number of Degrees
1990	780
2000	1305
2005	1824
2006	1882
2007	2035

Source: Statistical Abstract of the United States, 2010.

(a) Find a linear regression equation for the data and superimpose its graph on a scatter plot of the data.
(b) Use the regression equation in part (a) to predict the number of doctoral degrees earned by Hispanic Americans in 2009.
(c) **Writing to Learn** Find the slope of the regression line. What does the slope represent?

67. ***Population of New York*** Table 1.24 shows the population of New York State for several years. Let $x = 0$ represent 2000, $x = 1$ represent 2001, and so forth.

TABLE 1.24
Population of New York State

Year	Population (thousands)
2003	19,231
2004	19,301
2005	19,336
2006	19,367
2007	19,429
2008	19,490

Source: Statistical Abstract of the United States, 2010.

(a) Find the exponential regression equation for the data and superimpose its graph on a scatter plot of the data.
(b) Use the regression equation to predict the population in 2009.
(c) Use the exponential regression equation to estimate the annual rate of growth of the population of New York State.

AP* Examination Preparation

You may use a graphing calculator to solve the following problems.

68. Consider the point $P(-2, 1)$ and the line L: $x + y = 2$.
(a) Find the slope of L.
(b) Write an equation for the line through P and parallel to L.
(c) Write an equation for the line through P and perpendicular to L.
(d) What is the x-intercept of L?

69. Let $f(x) = 1 - \ln (x - 2)$.
(a) What is the domain of f? **(b)** What is the range of f?
(c) What are the x-intercepts of the graph of f?
(d) Find f^{-1}. **(e)** Confirm your answer algebraically in part (d).

70. Let $f(x) = 1 - 3 \cos (2x)$.
(a) What is the domain of f? **(b)** What is the range of f?
(c) What is the period of f?
(d) Is f an even function, odd function, or neither?
(e) Find all the zeros of f in $\pi/2 \le x \le \pi$.